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Climate, ecology and international security

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In 1972, Zbigniew Brzezinski wrote of the contrast between the time-honoured 'international' approach to world affairs and the more 'planetary' perspective lately favoured by radical youth. He suggested that political leaders guided by new concepts were needed to bring the two together.[1]

This thought has strong resonance in the aftermath of 1988, the year in which many millions of people around the world came to feel that ecological instability across the planet posed a most fundamental threat to the international order, a feeling to which governments have vocally responded. Drought in the American Middle West and floods in Bangladesh had a particularly dramatic effect on sensibilities, the fear being that they were symptomatic of the development of climatic instability as the atmosphere warmed through the accelerating accumulation within it of carbon dioxide (CO_2), methane (CH_4), and other man-produced 'greenhouse' gases. Moreover, this shift in the overall balance of radiation between earth and sky was paralleled by the sudden emergence of a qualitative threat due to the depletion, especially by man-made chlorofluorocarbons (CFC), of the stratospheric ozone: the layer that serves to protect all life on and near the earth's surface from short-wave energy from the sun and outer space. Quite often, indeed, the two issues have been confused with each other.

What should also be borne in mind, however, is that even without these distortions of the atmosphere, the world would still face a massive and complex crisis in its ecology, including such aspects of human ecology as agriculture and water supply. Perhaps the most stark indicator is the accelerating elimination of other species as a direct consequence of mankind's economic growth. The median estimate of the total number of plant and animal species extant throughout the world is around ten million. Many are now endangered everywhere. Most notably at risk, however, are the 50–90% of the total that are native to the tropical rain forest, where they are usually integral to very complex, finely tuned and highly localized ecosystems. Yet at current rates of destruction in Amazonia and elsewhere, a very large part of this forest area will disappear in the next 75 to 100 years.

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Many commentaries deplore the resultant loss to medicine and agriculture of so vast a genetic base. Over and beyond which, there is something unduly hubristic about the careless elimination forever of other forms of life. The ultimate effects on morale and motivation are hard to predict, but may be very negative and dangerous.

So should 'strategic studies' now extend its purview to accommodate these burgeoning ecological threats to stability and peace? When the subject first emerged as a distinct field of scholarly enquiry some 30 years ago, its principal aim was to help those operating in the defence and diplomatic fields to come to terms with nuclear deterrence. Practitioners took little interest in economic and social development, and largely ignored geography and even military history.

Thus were the bounds of strategic studies effectively set. President John Kennedy did try to formulate a global strategy that would have an interdisciplinary input; as much was reflected in a diversity of particular policies, and in various appointments made. Yet apart from the singular problem of nuclear tests in the ocean and atmosphere, international ecological issues were neglected. Nor is this surprising. After all, Kennedy died in 1963, while it was not until 1964 that Rachel Carson published *The Silent Spring*, the book that was the morning star of environmentalism. Barbara Ward did not coin the evocative term 'Spaceship Earth' until 1966.[2] On the other hand, extensive consideration was given by the Kennedy Administration to the global pursuit of economic and political progress, underwritten by military preparedness.

Perhaps a greater emphasis on international environmental issues would have evolved had Kennedy lived. As things transpired, interest in so grand a strategy all but died with him. Meanwhile, little attention was being paid by strategic analysts to the initial steps in the peaceful exploration of space, despite the major connotations for planetary management. The great exception had, of course, been *Sputnik* I. Yet even that had owed much to a mistaken belief that its launch bespoke a Soviet readiness to acquire large numbers of high-performance intercontinental ballistic missiles.

The dangers of too narrow a focus can readily be seen by reference to the Indian subcontinent, a region of the utmost importance geopolitically and one always extremely susceptible to ecological disequilibrium. Strategists have often weighed the connotations of India or Pakistan acquiring 'the Bomb'. Yet seldom have they dwelt on what could be the far-reaching strategic repercussions of either country experiencing an acute setback in development, a setback that might well be triggered by climatic disorder. Likewise, although the closure of the Suez Canal betwen 1967 and 1975 placed a grave incremental strain on the fragile economies in question, its strategic implications tended to be discussed exclusively in terms of how closure constrained the movement of Soviet warships and Western tankers.

Nor did strategists much consider social and ecological change in, say, Tibet, Nepal or Nagaland – change bound gradually to make the Hima-

layas less of a 'frontier of separation' than they have been historically. Nor, indeed, did they contemplate in advance, or even much in retrospect, the broader ramifications of the secession of the eastern wing of Pakistan. In 1988, two aspects came together with a vengeance. Forest denudation in the Himalayas aggravated a monsoonal flood surge that at one stage put 75% of Bangladesh under water. The resultant damage posed a threat of political instability well after the waters had subsided.

Growing ecological awareness

So what hope can there be that strategic studies will at last prove able to embrace ecological trends and their economic, social and political connotations? Part of the answer is that certain of its academic analysts, together with some of the public figures who from time to time assume a similar role, have long drawn attention to such linkages. This even applies to the greenhouse effect. In 1958, Edward Teller and a colleague noted that, if the combustion of hydrocarbon fuels drove up the level of atmospheric CO_2, this would act like 'the glass in a greenhouse', with a melting of the ice caps the ultimate result.[3] Ten years later, Andrei Sakharov was warning that CO_2 'from the burning of coal is altering the heat-reflecting qualities of the atmosphere. Sooner or later, this will reach a dangerous level.'[4]

Within the climatological community, on the other hand, a sense of urgency on this score was lacking for a long time. Presumably this was for the usual three reasons: the propensity of scientists to treat problems in isolation; to be almost obsessively reluctant to rush to professional judgments; and to be naïve about the ability of politicians to adapt. At all events, concern waxed slowly. An explicit reference to the effect can be found as early as 1861.[5] Then, towards the turn of the century, there was a flurry of interest much in line with the perception of frontiers closing everywhere so evident in the literature and politics of the time. After that, interest waned. The upshot was that not until the late 1970s did most climate specialists become persuaded that the cause for greatest concern was man-induced warming, rather than a natural trend towards cooling. In 1977, the then Director of the UK's Meteorological Office (himself a cloud physicist of considerable distinction) insisted that much more research was needed to predict 'the marginal effects of man's intervention in climate', effects that 'may well be masked by natural variation'. He also anticipated that the threat to stratospheric ozone from CFC and other chemicals would prove to 'have been greatly exaggerated'.[6]

In 1980, however, ecological awareness found wider expression as the Independent Commission on International Development Issues, chaired by Willy Brandt, formally presented its report to the UN Secretary General. One thing pressed for in it was a broader interpretation of security than had been customarily employed: 'Our survival depends not only on military balance but on global co-operation to ensure a sustainable biological environment and sustainable prosperity based on equitably shared resources.'[7] This theme was to come more into its own in 1987 in

Our Common Future – the report of another international study launched by the Secretary General and chaired this time by Gro Harlem Brundtland, then shortly to be the Prime Minister of Norway. The Brundtland report observed that: 'Environmental threats to security are now beginning to emerge on a global scale. The most worrisome of these stem from the possible consequences of global warming caused by the atmospheric build-up of carbon dioxide and other gases.'[8] About two-thirds of this effect was acknowledged still to be caused by the CO_2. By 1989, most analysts of the world scene did accept that both the greenhouse effect and ozone depletion are issues of grave international concern.

Climate and history

During recorded human history, swings in mean temperature of one or two degrees centigrade in the course of several centuries have affected the fortunes of individual societies and polities. Gradual upward shifts have usually appeared benign, while downward movement has generally been adverse. But a strong trend in either direction has very consistently been detrimental, not least because of the associated disruption of rainfall patterns. All the same, the evidence concerning the effect of climatic change on the biological environment, and hence on human society and politics, is both extremely complex and very incomplete. Furthermore, shifts in climatic norms have rarely been all that rapid. As a rule, the resultant impact has been most evident on rural margins that were barely above destitution at the best of times.

Nevertheless, some useful indicators are afforded by the 'Little Climatic Optimum' of the Middle Ages. From 900 to 1300 AD, a rise in mean temperature occurred, certainly in North America and Eurasia. During the first half of that phase, some 10,000 Vikings settled in what they named 'Greenland'. In the second half, the frontiers of agriculture in Western Europe typically ascended 200 feet, and hundreds of new towns were established. Great monastic orders were founded; scholasticism and Gothic architecture flourished. Likewise, in the very high Arctic, the Thule culture of Inuit Eskimos expanded at the expense of its southerly neighbours.

Then followed several centuries of general cooling. The Viking colonies in Greenland had died lonely deaths by 1450. By then, too, agricultural margins were receding across Europe, with upland villages being abandoned everywhere from Iceland to Hungary. In East Asia, the temperature turning point came a little earlier, and was associated with heavier rainfall. More moisture on their arid plains may have encouraged the extraordinary military and political expansion of the Mongols. Not long afterwards, torrential rains in East China swamped city drains, causing the rat-borne Black Death to surge around Eurasia (1348–50).

During the sixteenth century, the cooling accelerated. Growing anxiety about internal fragility may have induced China, then even more particularly Japan, to turn inwards to xenophobic isolation rather than

vie with Europe in industry and maritime commerce, something both countries had seemed poised to do.[9] The global trend evolved into the 'Little Ice Age' so famously depicted by the seventeenth century Dutch painters, and mentioned in many other contemporary accounts. Its nadir was to come very visibly in the 1840s; and that was also a decade of quite exceptional social stress and revolutionary ferment right across Europe. It saw the publication of *The Communist Manifesto*, and the occurrence of the potato famine in Ireland. Meanwhile, in the isolated Japan of the Tokugawa shogunate the population boom of the late seventeenth century had levelled off as infanticide much increased in response to worsening poverty on the agrarian margins. Everywhere, bad grain harvests (e.g., in Western Europe in 1313–20, 1594–7, 1788 and 1816) readily led to social unrest. Whether, as with 'the great fear' that swept a hungry France early in 1789, this culminated in political upheaval depended on other factors.

Yet, visible and consequential though this long phase of cooling had sometimes been, the mean temperature in middle northern latitudes had fallen not more than a couple of degrees between the thirteenth and nineteenth centuries. Then, between 1850 and 1940, there was a gain of one degree, an improvement that tended to assist the last great surge of European imperial expansion, and which some commentators have said is supremely reflected in the balmy image of Edwardian England, at least as seen in retrospect.

A remarkably abrupt and general reversal of this temperature trend was to occur around 1940. Its human consequences are apparent throughout the rest of the 1940s in a Europe in the throes of total, then 'cold' war. Bitter winters early on had direct military consequences. For example, they compromised both the Soviet campaign against Finland in 1939–40 and the German drive into Russia in 1941. Then came the winter of 1946–7, judged to be the worst in Europe for at least a century. An acute fuel crisis in the UK in February 1947 contributed to the decision to disengage from the civil war in Greece, thereby obliging the US to take over that commitment. An immediate result was President Harry Truman's enunciation of his doctrine of containment of 'direct and indirect aggression', perhaps the biggest single landmark in the strategic response to Stalin. Several months later, the Marshall Plan was launched, considerably because of the way the winter cold had further retarded the already too slow recovery from the war of Germany and its neighbours.

Global cooling is quite regularly associated with a shift towards the equator (in both the northern and the southern hemispheres) of a most singular feature of the Earth's climate: the sub-tropical belts of high pressure with their descending air, very dry skies and desert landscapes. As this pattern reasserted itself from 1960, the Sahel region of Africa was acutely affected. In the 1950s, the summer rains from the south had tended to penetrate to 20–22°N. By the early 1970s, however, their general limit was 19–20°N. The ecological, and hence the political, implications were serious for everywhere north of 10°,[10] long a zone of contact

and conflict between Black African and Arab. Historians should be left to assess how far drought aggravated political tensions from Mauritania through Chad and Nigeria to the Sudan. What is very evident is that drought helped to pave the way for the revolutionary coup in Ethiopia in 1974, but then exposed even more starkly than might otherwise have been the case the shortcomings of the revolutionary regime.

A somewhat anomalous feature (see below) of this climatic phase was some weakening in the circulation of the atmosphere in temperate latitudes. This meant, in particular, that moist maritime air would tend to penetrate continental regions less readily, leaving exposed coasts still wetter and continental interiors even drier. At times, rogue anticyclones (i.e., cells of high pressure) would effect a radical diversion of the prevailing winds, precipitating harvest calamities. Recurrent shortfalls in rain helped to defeat Khrushchev's 'Virgin Lands' drive from 1955, and to devastate Mao Tse-tung's Great Leap Forward from 1958. In the lower Volga, crop potential, judged just in relation to rainfall, was a good 25% lower from 1951–60 than over the next ten years.[11] India's internal stability looked more at risk after the monsoon failures of 1965 and 1966. But in the 30 years between 1940 and 1970, the decrease in global mean temperature was only 0.3°C (albeit a little more in the northern hemisphere).

The greenhouse effect and its impact

As 1980 dawned, it was confirmed that the decade just ended had recorded a net rise in mean air temperature of 0.25°C. Collaterally, the area of sea ice had contracted by two million square kilometres in each polar region. Moreover, the new trend has continued this decade. According to a recent study at the Climatic Research Unit at the University of East Anglia in the UK, the six warmest years on the global record are (in ascending order) 1986, 1980, 1981, 1983, 1987 and 1988. In short, greenhouse warming is now coming through all the more strongly for having been masked again in the recent past by the longer-term natural trend towards cooling.[12] What is more, 1991–2 is likely to see an exceptionally strong peak in what basically averages out as an eleven-year sunspot cycle. The likelihood is that the approaching peak will raise temperatures at the Earth's surface a little faster, while increasing the incidence both of scorching droughts and of unduly wet seasons.

A fairly solid consensus has lately built up among the climate modellers about the overall magnitude of the coming problem. A useful datum point is a doubling, as from the start of the Industrial Revolution, of the 'carbon dioxide equivalent': a weighted summation of the several greenhouse gases. On current showing, this point will be passed sometime between 2030 and 2050. This would cause a concurrent temperature rise of another two or three degrees: a rate of change five to 15 times as fast as the historical ones reviewed above. Another degree or so would then be registered over the next 30 to 40 years, even if no further accumulation of greenhouse gases occurred.

The various computer programmes are in quite broad agreement about how a mean temperature rise of three degrees, say, would be spread latitudinally. The change would be barely one degree near the equator, but up to five near the poles. Since quite early on in the systematic study of climatic change through the ages,[13] it has been recognized that temperature trends that are hemispheric or global in extent tend to be more pronounced towards the poles. As a rule, about 90% of the direct sunlight is reflected off a polar-ice sheet; expansions or contractions of pack-ice or snowfields are therefore liable to be self-reinforcing. This applies especially to Arctic pack-ice and to the broad ice shelf of the West Antarctic. Some ten thousand years ago, during the most recent 'Ice Age' glacial retreat, Greenland may have warmed as much as seven degrees in 50 years as the ice receded fast and ocean currents realigned.[14]

The implications may be serious. A key determinant of climatic change is any alteration in the temperature contrast between the equator and either pole. The North Pole, for instance, is an average of 68°C cooler than the equator in deep midwinter and 32°C in high summer. The global circulation of the atmosphere and, indeed, the oceans ultimately depends on the thermal drive provided by these temperature gradients. Any reduction of the differences will eventually diminish this drive and hence circulatory vigour, especially in temperate latitudes. Again, continental drought will be the most serious consequence.

At the same time, the subtropical high pressure belts will be liable to swing polewards to the benefit of the Sahel, but causing rainfall deficiencies in various other regions, not least the Levant and southern Africa. Among the political effects could be further exacerbation of two of the most focal of contemporary communal conflicts: that between the Israelis and the Palestinians, and that in and around South Africa. Soil erosion and/or water shortage are already major bones of contention in each situation. Meanwhile, the peoples most intimately involved show little inclination, in the absence of adequate progress towards a political settlement, to accept constraints on their own population growth, thereby intensifying pressure on soil and water.

Various other questions concerning the greenhouse effect still await elucidation, mainly through the advent of more powerful computers. Modelling the temperature effects of variations of humidity and cloud cover at different heights needs to be refined. In the meantime, the General Circulation Models of the atmosphere remain much at variance one with another over changes as between different longitudes, especially as regards rainfall distribution. Nor can it yet be predicted with any precision how a given climatic change will affect a complete ecosystem. The resulting uncertainties concern not least the temperate latitudes. Will Western Europe be affected more than north China? Will the American Corn Belt dry out while the Prairies flourish? Will European Russia gain?

Ocean currents and levels

The Southern Oscillation, the most noted of various long-range circulatory correlations, is the tendency for air pressure in a broad zone around Darwin to vary inversely with that in another such zone around Tahiti. This mechanism is closely interactive with the El Nino surges of warm water into the cold ocean current off Peru. These surges tend to be driven by a rise in sea temperature in the West Central Pacific, a sea area in which a rise of even half a degree may similarly trigger a significant increase in convective shower activity or typhoon genesis in the atmosphere above. That, in its turn, may deny water to the Asian monsoon.

In 1983, 1987 and 1988 the El Nino was strong, and is assumed, in fact, to have contributed to the global warmth of each year.[15] But nobody yet knows the exact causal linkage nor, indeed, how long the whole El Nino Southern Oscillation mechanism would survive sustained greenhouse warming. There is still a lack of 'operational coupled ocean-atmosphere models for prediction of phenomena such as El Nino and the Southern Oscillation'.[16]

There is also an insufficiency of data about oceanic circulation. On the floor of the Denmark Strait, for example, there is a continuous cascade in which water plunges nearly four times as far as any waterfall on land, and has a throughput 400 times as great as any.[17] Such features may be enormously important as agents of heat transfer. Inadequate understanding of just how the oceans circulate also makes it harder to predict rises in mean sea level (MSL) as ice melts and as ocean water thermally expands. But a rise in MSL of somewhere between 25 and 40 centimetres seems likely between 1985 and 2025, to be followed by as much again by 2060.[18]

In some coastal locations, this trend will be either constrained or reinforced by isostatic shifts, upwards or downwards respectively, of the land mass in question. For instance, the south-east coast of England is at present sinking at a rate of 50 cm a century. A net MSL rise of a metre or more would place a severe strain on the systems of embankments required to protect many low-lying and well-populated areas. Thus, both Egypt and Bangladesh could be threatened with the permanent loss of one eighth of their arable land, while Bangladesh could be even more liable to find its monsoon inundations surging out of control. At the same time, several of the small island nations (e.g., the Maldives) could virtually sink beneath the waves.

The scope of today's climatic problem

On balance, seven billion tons of carbon enter the atmosphere from the land every year, largely in the form of CO_2. Three-quarters of it is derived from the consumption of fossil fuels, the rest from deforestation. Nearly a half of this carbon gain from the land is currently offset by a net absorption by the oceans.

The scale of the aggregate masses and flows indicates that changes in our global economic strategies, notably in regard to energy consumption and deforestation, can considerably affect the rate of greenhouse

warming. In addition, however, heavy intakes of carbon by the colder seas suggest that plankton play a major part in the transference of carbon/carbon dioxide from the atmosphere to the oceans. British oceanographic work seems lately to have yielded fresh evidence that this is indeed the case.[19]

A possibility that the plankton might be induced to absorb rather more atmospheric CO_2 is sometimes cited as 'confirming' the 'Gaia' hypothesis, which says that all life on Earth is committed to collective preservation through environmental control.[20] But it would be quite wrong to look to the Gaia hypothesis to head off the greenhouse threat just like that. If Gaia works at all, it does so rather unevenly across thousands or millions of years. Nor is it concerned with the preservation of human society as such – and still less with the preservation within it of liberal values or any civilized norms.

Among other grounds for concern is the possibility that, as sub-polar regions such as the Siberian tundra and the Canadian shield get warmer, the more peatish parts of their permafrost soils will yield up vast amounts of methane that have not thus far been reckoned with in greenhouse budgets. Another factor that tends currently to be ignored by the modellers is straight 'thermal pollution': the sheer production of heat in the course of man's economic activities.

So, all in all, global warming might proceed significantly faster than the present consensus predicts. On worst case assumptions, the rise in mean temperature over the next century could begin to approach the ten degree increase estimated to have taken place between the bitterest phase of the last glaciation (around 18,000 BC) and the present day. Put in such terms, the challenge begins to look rather like 'the moral equivalent of war', not least because a failure to meet it would have catastrophic consequences for international security.

Hawks and doves

Evoking a response will involve a twin-track strategy of *(i)* reducing and delaying the onset of crisis; and *(ii)* suitably adjusting to it. The former approach may require, among other things, new modes of influence upon nation states by an international community in pursuit of such objectives as energy economy. Over 20 years ago, Thomas Schelling wrote of the problem he termed 'compellence' as opposed to 'deterrence'.[21] Dissuading a regime from embarking on some negative course of action (i.e., deterrence) is rarely easy, even when *force majeure* can be boasted. But it can be a lot harder still to compel or persuade it to launch out on such policies as may be regarded as positively constructive. Part of the difficulty, not least in relation to the contemporary political culture of the US, is the tendency to adopt trite applications of behaviourist psychology, rewarding welcome conduct and punishing that which is unwelcome in all too obvious a manner. Another aspect is what Robert McNamara has been wont to call the 'action-reaction' phenomenon: the tendency for the hawks on each side of a divide to

reinforce one another or, more rarely and tentatively, for the doves to do so. In the context of environmental control, the hawks should normally be defined as those who put narrow national interest before all else.

In all situations of conflict in the modern world, full account should be taken of the subtleties of 'compellence' and of 'action-reaction'. That accepted, it does seem that part of the response to greenhouse warming has to be renewed attention to the global projections of armed force, in order to curb the violence that climatic instability is liable to engender regionally. To purists, indeed, this military requirement will epitomize still the very essence of strategy, which as 'a word stemming from the Ancient Greek term for a general or generalship refers to the relating of military power to political purpose'.[22] Never mind that a subject may have to change its definition in order to remain vital. In Ancient Greece, both 'economics' and 'ecology' had connotations much more domestic than is ever the case nowadays, each being derived from *oikos* – the word for 'house'.

Clearly, the strategic community will not find it easy to effect a meeting of minds, not just with economists but environmentalists as well. To an extent, of course, it is a question of differences in political balance. Both strategists and environmentalists extend across quite a wide range of opinion. Nevertheless, it would be fair to say that only the former accommodate, albeit uneasily, the hard Right; and that only the latter embrace the more utopian Left, complete with its arbitrary anti-militarism, its Manichean attitudes to nuclear energy in whatever form, and its quasi-Maoist obsession with how the super-powers 'compete and collude'. The dichotomy became very evident during the Vietnam War. To the environmentalists, the damage to Indo-China's ecology was a salient aspect of the conflict. To the strategists, it was quite secondary.

Even so, important issues are emerging about which constructive dialogue ought to commence between the 'greens' and the strategists, between the 'planetary' and the 'international' perspectives. One consideration is that such environmental threats as deforestation have accented again one of the classic objections to the unregulated market economy: namely, that a free-market system driven simply by individual preference fails to recognize what growth may mean in terms of 'external diseconomies' for individual countries and for the world at large. But how far should this be corrected by straight regulation as opposed to financial inducements or penalties? How far should the wider costs be borne by producers as opposed to government? And might these questions also inject new life into the old debate about the relative merits of democracy and dictatorship?

Impact on the affairs of states

No less vexing are the consequences for relations between states. Thus, in the USSR today, the diplomatic overtures that President Mikhail Gorbachev and Foreign Minister Eduard Shevardnadze have been making about planetary management for the benefit of all are coming

obliquely under attack from more hawkish, conservative elements. Some of these would argue that greenhouse warming could, in fact, be a boon for much of Soviet agriculture, so laying the foundations for progress towards the long-heralded era of 'socialist abundance'. It is akin to the way Marxists used to depict the Malthusian crisis of overpopulation as but a 'contradiction of capitalism', part and parcel of its supposed propensity to impoverish the masses.

The planetary implications of such a dialectic in so large a country are well highlighted by an issue that first burgeoned in the decade after Stalin's death: the regional modification of climate by controlling the flow of water into, or the ice cover over, the Arctic. By 1965, proposals under consideration included those for the wholesale diversion of the great Siberian rivers – the Ob, Lena and Yenisei – southwards to the rain-deficient lands of Soviet central Asia. Planning proceeded against a background of considerable controversy within the Soviet scientific community about the logistical and ecological implications. Meanwhile, analysts elsewhere began to warn of great uncertainty regarding the effects on the climate of the Arctic, and hence on that of the world. The government of the UK made formal representations along those lines in 1969.[23]

Within months of Gorbachev's accession to power, this huge endeavour was subject to rumblings of political disapproval,[24] and in August 1986 it was cancelled. Speaking in Murmansk in October 1987, Gorbachev urged all the circumpolar countries to collaborate through treaty in the ecological management of the Arctic region. Presumably, however, such collaboration could only be implemented within the context of an arms-control regime, which might be hard to establish. Nor can it be assumed that the diversion of the Siberian rivers has been set aside for all time. On the contrary, the USSR might well be tempted to resurrect the plan if the four constituent republics of central Asia were to be parched by several decades of greenhouse drought. Yet against the background of a global greenhouse environment, the effects on the Arctic's climate and ecology could be all the more ruinous. The loss of so much fresh water would leave that sea more saline, and therefore less prone to freeze in winter; as a result, its ice sheets might contract all the faster.

At present, Brazil is the major focus of protest for planet-minded Western radicals, youthful and otherwise. However, China is another large country in which the struggle between a narrow ecological hawkishness and a broader planetary perspective is currently being hard fought.[25] These past four decades, the battle-lines there have closely coincided with those about economic and political freedom, and about openness to the outside world. Thus, in 1982 the 5th National People's Congress passed a far-ranging basic law on environmental protection. It also approved a new draft constitution which, along with collateral changes in the Communist party structure, gave less free a rein to totalitarian orthodoxy.

How seriously to take the threat of greenhouse warming is one theme that has been debated in China, one school of thought dubiously con-

tending that (thanks to a presumed upturn in volcanic activity) cooling will remain dominant.[26] Meanwhile, a dialectic has also been in progress regarding the depletion of the ozone layer. The 1987 Montreal Protocol calls, *inter alia*, for a reduction of at least a half by the turn of the century in the consumption of CFC, the substances that do most to erode high-altitude ozone, as well as acting as potent greenhouse gases. China has yet to sign the Protocol; in fact in February 1989 the authorities there announced a more than ten-fold increase by the year 2000 in China's production and consumption of CFC. But at the international conference held in London in March 1989 on 'Chlorofluorocarbons and the Ozone Layer', the Chinese delegate (backed by the Indian) proposed a global fund to supply technology and assistance free of charge to developing countries to enable them to phase out the use of CFC. Clearly, there was scope for positive 'action-reaction', for a constructive interchange between 'north and south' about a recognized planetary menace. Unfortunately, however, the prospects for this must diminish if China turns more martial, conservative and introspective in the aftermath of Tiananmen Square.

Within the European Community, environmental concern at the national level led to the collapse in May 1989 of a government, the Centre-Right coalition in the Netherlands. Most immediately, the intense concern felt by the Dutch about such issues stems from the pressures of pollution consequent upon high population density, this in a location very much at the hub of the Common Market. Also, the Dutch are strongly conscious of the threat posed historically by rising sea levels. During the Little Climatic Optimum of the thirteenth century, the incidence of severe sea floods around the North Sea basin was quite extraordinary. In 1212, for instance, 306,000 people were drowned in North Holland.[27] Later, during the global atmospheric warming of 1850 to 1940, the MSL at the Amsterdam tide-gauge rose 15 cm.[28]

Throughout 1987, the Dutch Centre-Right coalition worked on a comprehensive environmental plan. Against a background of acute economic austerity, however, it proved impossible to secure agreement on how to finance it, an impasse which eventually brought about the coalition's downfall. As promulgated by the caretaker government that assumed office pending the September 1989 elections, the plan includes several hundred measures to reduce all forms of pollution by between 70% and 90% by the year 2010. Environmental control will by then be consuming 3.5% of the Dutch gross national product, a proportion more than double the present level and – one might add – close to that which the Netherlands is currently spending on military defence. The declared aim is to make 'the polluters' meet 80% of the incremental burden.

It was also in May 1989 that the eight Amazonian nations met in Manaus to co-ordinate policies on environmental and economic development. This event shows how Latin America has come of late to signify the new awareness of the need for 'international' and 'planetary' perspectives to interact. Meanwhile, a campaign has been building

strongly both outside and inside of Brazil against the reduction and pollution of that country's vast tracts of Amazonian forest by 'cattle barons' and gold-diggers. It is a campaign which has striking similarities with that against the 'drugs barons' in Colombia. Among other regional issues of global import is the acute susceptibility to the El Nino of the plankton that feed the rich anchovy grounds off Peru. The abrupt collapse in 1973–4 of what had been an astounding fishing boom was an alarming case in point.

Implications for strategic studies

As with nuclear deterrence 30 years ago, strategic studies may be poised for what Thomas Kuhn would call a 'paradigm change': the adoption, within an academic community, of a new corpus of knowledge and ideas.[29] In the formulation of a twin-track strategy to grapple with the ecological threat to peace, the main emphasis these next few years should be on identifying the best techniques for damage limitation, and how these might be applied multilaterally at the regional and, more especially, the global level. How can deforestation be restrained and afforestation encouraged? How far can plankton be mobilized against atmospheric CO_2? What of energy conservation? How can the action-reaction phenomenon be turned to advantage in this sphere? And in what ways do the new imperatives relate to socio-political change across the world, and to the continuing requirement for military defence?

By the turn of the century a more precise idea should have been formed as to what levels of greenhouse gas might be expected, and what climatic distortions may result: above all, what shifts in rainfall patterns may occur. The impact on regional ecosystems of given climatic changes within given timespans should also be better understood. Accordingly, it should then be possible to look more definitively at regional strategies designed actively to promote peace and progress, not least through various modes of economic support. Strategists will thus find themselves presented with a large, diverse and unfamiliar agenda. But it will be one informed by the precept that if doom can be foreseen, it may be thwarted. Such self-defeating prophecy is what good strategy has always been about.

Notes

[1] 'The International and the Planetary', *Encounter*, vol. XXXIX, no. 2, August 1972, pp. 49–55.

[2] *A Supplement to the Oxford English Dictionary*, Oxford, 1986, IV, p. 379.

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